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Report on Quaternary fieldwork in the Millinocket area, Maine, carried out between Oct. 23 and Nov. 15, 1992

Bjorn G. Andersen

UNIVERSITETET I OSLO

INSTITUTT FOR GEOLOGI
POSTBOKS 1047
BLINDERN, OSLO 3
SENTRALBORD 45 50 50

UNIVERSITAS OSLOENSIS

BLINDERN.

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Dear Walter and Woody.

Finally I am back from Chile, and I have tried to finish the report on my Millinocket-work. I should have liked to spend more time on the report, but I hope that it is readable and acceptable as it is. At present I am loaded with work and duties, and I will not have time to ~~do~~ more with the report before the summer.

I enjoyed very much doing the field work in Maine, and I particularly enjoyed visiting your homes and meeting your families. Walter, please remember me to Ann, and Woody please remember me to Louise, and thank them for the hospitality. If you happen to come to Norway you are welcome to stay in my home. It has plenty of space for guests!

Well, I am looking forward to meeting you again soon, and I wish you all the best for the coming season.

Best regards,

Bjørn

Regards also from my wife Astrid!

Report on Quaternary fieldwork in the Millinocket area, Maine, carried out between Oct. 23 and Nov. 15, 1992

The fieldwork was focused on:

1) finding the evidence of active glaciers during the deglaciation period.

2) determining the marine limit, and in that connection map deltaic deposits which particularly occur along the large esker systems.

3) dating the deglaciation.

4) a general reconnaisence mapping.

I will start this report with a review of the general mapping.

General reconnaisence mapping

The mapping was based on studies of aerial photographs and observations along the roads, in particular the logging roads in the forests. Altogether 9 quadrangle maps were more or less covered. Considering the short field period, only a very brief reconnaisence mapping could be carried out, and it had to be focused very much on the problems I was trying to solve. The forest-vegetation is very dense in most parts, and there were no exposures away from the existing roads. Many of the logging roads were not in use, and in very poor conditions. Therefore, much of my "hiking" were done along such roads, and only a few longer tours were made away from the roads.

Results

Most of the results related to the problems mentioned in paragraphs 1, 2 and 3 will be described in their special sections, and only a few general remarks will mentioned in this section.

Close to 100% of the observed area is covered with Quaternary sediments. Tills cover about 80% (?) (excluding lakes), and about 18% (?) is covered with glaciofluvial sediments. Fine-grained marine deposits have been observed only in very limited areas (1% ?) and in a few stratigraphic sections. Inorganic lacustrine sediments have not been observed on dry land. Organic sediments, such as bogs, cover only very small areas. Bedrock has been observed at a few, very small exposures.

Till covers
Basal till

The larger scale hills and ridges between the main valleys generally have a "smooth" surface covered with basal till. this till is generally bouldery, and large granite boulders are frequently exposed at the surface. They are derived from the Devonian granite which underlies most of the area. However, the areas adjacent to the east branch of Penobscot River are underlain by Cambrian and Silurian sedimentary rocks, and those areas are covered with finer-grained basal tills, almost without large boulders, and with practically no granite erratics. Apparently granite erratics were not transported far in east direction from the granite areas. This corresponds well with the direction of the "drumlinoid" ridges, which is oriented close to N-S, adjacent to the east branch of Penobscot River. Projecting knobs and mountain tops are frequently elongated in the former ice-flow direction. They have a "tail" which points in this direction, and I have called them "drumlinoid". The most typical of them are marked with arrows on the map. They show the main ice-flow direction which was in SE-direction in most of the area, but towards the east branch of Penobscot River it changed gradually towards the south. Typical drumline fields have not been observed.

On map sheets Trout MTs, Whetstone MTs and Norcross Quadr. the smooth surfaces with basal till generally dominate above the 600-700 foot level. Below that lever the topography changes abruptly, and it becomes irregular bumpy with distinctive ridges. This kind of topography covers the lower parts of the valley sides and the valley floors. Some of the ridges are glaciofluvial, but most of them are socalled ribbed moraines which will be described in a following section.

Ablation till

The bumpy topography with the moraine ridges which covers the lower parts of the valleys on the above mentioned 3 map sheets probably (?) represents an ablation moraine. The surface of these moraines are covered with large granite boulders, and existing exposures suggest that the till is bouldery and sandy. However, is this an ablation till? And what is the origin of the many distinctive moraine ridges, the ribbed moraines? This will be discussed in a later section. The bumby topography is best developed in areas adjacent to Millinocket Lake, and it is almost absent in other areas such as areas covered by the East Millinocket Quadrangle.

Marginal moraines

Numerous more or less distinctive moraine ridges, which lie transversely to the former ice-flow direction have been observed. However, none of them are clearly end-moraines, but some could be. I have marked them on the map. The most prominent ridges are the ribbed moraines which will be discussed later.

Glaciofluvial deposits

The most dominant glaiofluvial deposits are connected with the esker systems in the main valleys, the Millinocke River Valley and the east branch of Penobscot River Valley. A similar system lies in Salomon River Valley. A prominent esker-system occupies the valley upstream from Togue Pond in Baxter Park, and finally a long esker-system lies in the Trout River system to the northeast of Millinocket Lake. Because of the short time available I was unable to do any accurate mapping of much more than the central esker-ridges within each system. Most time was spent with the systems in the downvalley parts of the Millinocket Valley and the East Penobscot Valley, where features related to marine limit (ML) could be studied.

The Salomon River Esker is large with several large gravel pits. It was not studied.

The East Penobscot Valley Esker is by far the most dominant esker in the area, and there are several gravel pits connected with it. The central esker-ridge can be traced almost continuously through the area. It lies along the west side of the river, but there are gravel deposits at some localities on the east side too, which belong to the esker system. I have indicated a lateral limit for the glaciofluvial sediment cover, but this limit is not checked carefully and the cover could be more extensive. The esker ridge is frequently flattopped, and I consider it to be a kind of De Geer Esker formed more or less successively as the ice-front retreated. Details of the esker will be described in a later section about ML.

The Trout River Esker is long, but not as high and dominant as the East Penobscot River Esker. It occupies a higher-lying, broad valley system. Only sections of the system have marked esker-ridges. A ridge is particularly well-developed along the road in the northernmost part of the mapped area. In the southern part the glaciofluvial deposits are spread over a much wider area. They were observed almost everywhere along the old logging-roads. Much more mapping is needed to find the exact extent of the deposits. The southernmost part of the esker system has a SW-direction, which indicates that much of the subglacial rivers drained towards Millinocket Lake. Distinctive ridges which run downslope to the lake are marked as moraine ridges on the map, but some of them could be esker ridges.

The West Millinocket River Esker

This esker system starts with a marked ester ridge in the Millinocket Lake, and it can be traced continuously downvalley to Millinocket City. However, only short segments have well-developed esker-ridges. The valley is wide in the downvalley part, at Millinocket and about 3 km northwards. In this part there is much gravel, with several gravel pits, but in general no well developed esker ridge. Most of the gravel lies along the eastern valley side. However, a broad flat-topped ridge and a hill (with a pit) on the west side of the river (opposite the school) belongs to the esker-system which grades into sandy terraces. The sandy terrace at Little Italy is best developed. The terrace along the west side, at the factory, is narrower and much destroyed by human activity. A closer description of the terraces will be done later, in the section on ML. A fairly broad sandy-gravelly, low-lying terrace along the river was mapped as post glacial.

A branch from the subglacial drainage in Millinocket Valley probably crossed eastwards over the low pass towards Dolby Pond. This is a densely forested area, and I spent much time there trying to locate esker ridges. It was almost impossible to distinguish between ground covered with till and ground covered with glaciofluvial deposits, due to the thick vegetation cover. I observed a few hills and short ridges which were most likely glaciofluvial (I used the spade to dig pits), but I was unable to observe any distinct esker system. At one place there is a marked shallow erosion channel. I also walked back and forth from Millinocket to Dolby Pond along the railroad. There were no good open pits or sections along the railroad, but shallow exposures indicated till cover at most places, except on the Dolby Pond Delta, see later description. However, small surface exposures on a ridge close to the "pass" showed a very gravelly sediment which was most likely glaciofluvial. I have added question marks to some ridges which could be glaciofluvial, and need to be checked. The large Dolby Pond Delta was probably mainly deposited by glacial rivers from Schodic Stream Valley, but a considerable glaciofluvial drainage could have crossed the mentioned pass also.

<u>The Baster Park esker</u> is a very distinctive ridge with several small cettle holes. In fact, very much of the interesting topography in this part of the national park is formed by this esker system. The esker extends westward for a considerable distance, but I have not done any mapping there.

<u>Glaciomarine sediments</u>

Finegrained stratified sediments, mainly silts, were observed in small roadcuts along the road north of Medway, in the lower part of East Penobscot Valley. The sediments lie in a narrow zone along the river and road, but the exact lateral extent was not mapped. I suppose that they are glaciomarine. Patches of glaciomarine sediments were observed in the gravel pits to the west and south of Medway. They lie on the northeast slope of the esker ridge. Finegrained glaciomarine sediments were observed in dump-piles with material dug out from the factory ponds at East Millinocket. Apparently finegrained glaciomarine deposits, mainly silts and some clay, lie along the sides of the rivers near Medway - East Millinocket. Finegrained sediments, fine sand, exposed in the "gravel pit" at the junction between Millinocket and the west branch of Penobscot rivers are possibly glaciomarine, and reports from people indicate that fine-grained sediments have been observed on the river banks at Millinocket. However, I did not find that kind of sediments. In most places, both near Millinocket and Medway, the glaciomarine sediments are more or less covered with postglacial sediments. A more detailed description of some of the glaciomarine sediments is presented in a later section.

<u>Evidence of active glaciers during the deglaciation period.</u>

<u>Marginal moraines and ribbed moraines.</u>

I was asked to look for marginal moraines and evidence of active glaciers. As mentioned before there are numerous moraine ridges which are oriented transversely to the former ice-flow direction. Unfortunately I could not reach and study most of them in the field, but judging by their appearance on the aerial photographs I am unable to tell that any of them are definitely true end moraines. Still I can not exclude that some of them could represent "poorly developed" end moraines. The most abundant and most striking moraine ridges are what I have called the ribbed moraines.

Ribbed moraines (Rogen moraines?)

The ribbed moraines are from a few meters to more than 30 m high, distinctive moraine ridges which have a "transverse orientation". They lie in swarms of more or less parallel, closely spaced ridges, and they cover large areas in the broad valleys adjacent to Millinocket Lake. The ridges frequently start on the lower part of the valley slope and continues onto the flat valley floor. They are usually fairly straight or slightly curved with their convexity facing upvalley. In that respect they are very different from normal end moraines which usually form lobes with the convexity facing downwalley. Judging from 3m to 6m deep sections in gravel pits in the ridges they consist of unsorted bouldery, gravelly, sandy till. No evidence of stratification was observed. Fabric analysis was attempted in several pits, but I had to give that up. First of all, there were very few good elongated pebbles and cobbles, and the few good ones which could be measured gave a completely "confusing" pattern with no preferred orientation direction. Many boulders are very large granites, and the same kind of boulders are very abundant on the surface of the ridges. Most ridges are rather steep-sided. The most striking ridged lie in the broad valley north and northeast of Millinocket Lake. Many of them start at a very marked level between 600 and 700 feet. They start at a very hummocky terrain, which looks like a dead-ice terrain. The valley slopes above this terrain are relatively smooth.

What is the origin of the ribbed moraines? and are they Rogen moraines? I had no field experience with Roger moraines in Scandinavia, and I knew them only from pictures and descriptions in the literature. In addition, I know that there are many different theories suggesting that they were formed subglacially. Obviously the pattern of the Millinocket ribbed moraines was much the same as the pattern of the Rogen moraines, but could they be classified as Rogen moraines? In my attempt to solve this problem I visited professor Jan Lundqvist in Stockholm. He looked at my maps and my photographs, including some aerial photographs, and he stated that the Millinocket moraines are most likely Rogen-type moraines. I then asked him if he could tell me how they were formed. The answer was no, except that they must have been formed in two phases (two steps) if they were true Rogen moraines. The first phase is the original deposition-phase, and during the second phase the Rogen moraines were overridden and partly remodelled by the glacier. Lundqvist gave me literature about the Rogen moraines, which I have now studied. The best paper is a review article which I include in my report. There Lundqvist gives brief summaries of the different opinions regarding the origin of the Rogen moraines. He also presents a definition where he says that the ribbed moraines must be associated with drumline fields in order to be called Rogen moraines. He also presented a theory which he seemed to favour. In this theory he suggested that the Swedish Rogen moraines could have been originally formed during an Early Weichselian glacial phase, and later overridden and slightly deformed at the same time as the drumline field was formed. In many cases, but not always, an ablation till was observed on top of a "basal till" in the ridges, and often lenses or beds of stratified material occur within the ridges. Based on the mentioned definition and description I find it impossible to classify the Millinocket ribbed moraines as typical Rogen moraines. I find no drumline field associated with the moraines, and no

evidence of an overriding glacier which has partly deformed the ridges. The higher hills which surround the valley are "drumlinized", but that must have happened during an active phase before the ribbed moraines were formed, and no true drumlines and drumline fields exist. The distinctive break on the valley slope between a smooth upper past and a very hummocky dead-ice moraine like zone immediately below the break clearly indicate that the upper part was smoothed by the glacier before the bumpy part with the ribbed moraines was formed. Therefore I will not call the ribbed moraines for Rogen moraines. Still, the typical pattern of the Millinocket moraines suggest that they could have the same origin as the moraine ridges at Rogen. Only at one locality, pit 4 on the Norcross Quadr., did I observe evidence of glacial overriding of a ridge. There the large boulders in the pit are clearly striated by an overriding glacier, direction S10°E. However, this ridge is broad and low, and it is questionable if it belongs to the ribbed-moraine system.
Lundqvist suggested that the Rogen moraines were formed during two phases, and I will suggest that the Millinocket moraines were formed during the first of the two phases. Lundqvist indicated that the origin presented by Bouchard could explain the first phase, and I want to indicate that the origin suggested by Bouchard could be the only origin of the Millinocket moraines, or it could explain much of how the moraines were formed. According to Buchard the ridges were formed subglacially near the ice front by stacking of slices of debris-rich ice against obstacles to the glacier flow.

The correct explanation for the Millinocket moraines must include explanations of the following features:

1. The Rogen pattern.

2. The fact that most of the distinct ridges start at about the same level only 200 feet above the valley floor.

3. A hummocky "dead ice" terrain which exists at the level where the ridges start, and not higher up on the valley slope.

4. The ridges seem to consist of the same kind of till from top to base.

5. No stratification and glaciofluvial beds were seen within the ridges.

6. The ribbed moraine ridges lie in a valley on the "lee-side" of the highest mountains in Maine.

According to the known deglaciation pattern in Maine, the Millinocket Lake area was most likely deglaciated sometime between 13.000 and 11.000 years ago. At that time the climate was still rather cold, and that may explain why so little melting and deposition of glacio-fluvial material took place on the moraines. Within the western ribbed moraine area, adjacent to the road to Baxter Park, there is no glaciofluvial material even between and adjacent to the moraines. The lack of glaciofluvial material associated with the moraines could also indicate that the ice was thin, there was not a thick ice on top of the moraines when they were formed, an ice which could melt and supply glaciofluvial material.

This explanation corresponds well with the low-lying upper limit for the moraines and the hummerocky terrain on the valley slope. May be the surface of the glacier was not very much higher when the moraines were formed? The ice must have been loaded with granite erratics from the high mountains. The same mountains acted as a "barrier" for the general flow of the ice sheet, and the glacier on the lee-side was left without much supply from the ice sheet during the late phases. In that way the surface of the ice in the Millinocket Lake area dropped. Mainly local ice from the mountains pushed into the valley and allowed some activity in the rather thin ice, where the frontal part gradually stagnated. This glacier activity was the cause of the shearing and accumulation of the debris, in about the same manner as Bouchard indicated. The following crude drawings indicate in which manner I visualize that the formation of the Millinocket ribbed moraines took place. More field work is needed to find the final answer, but my work may represent a basis from which future work can start. I still see problems which are difficult to explain with my model.

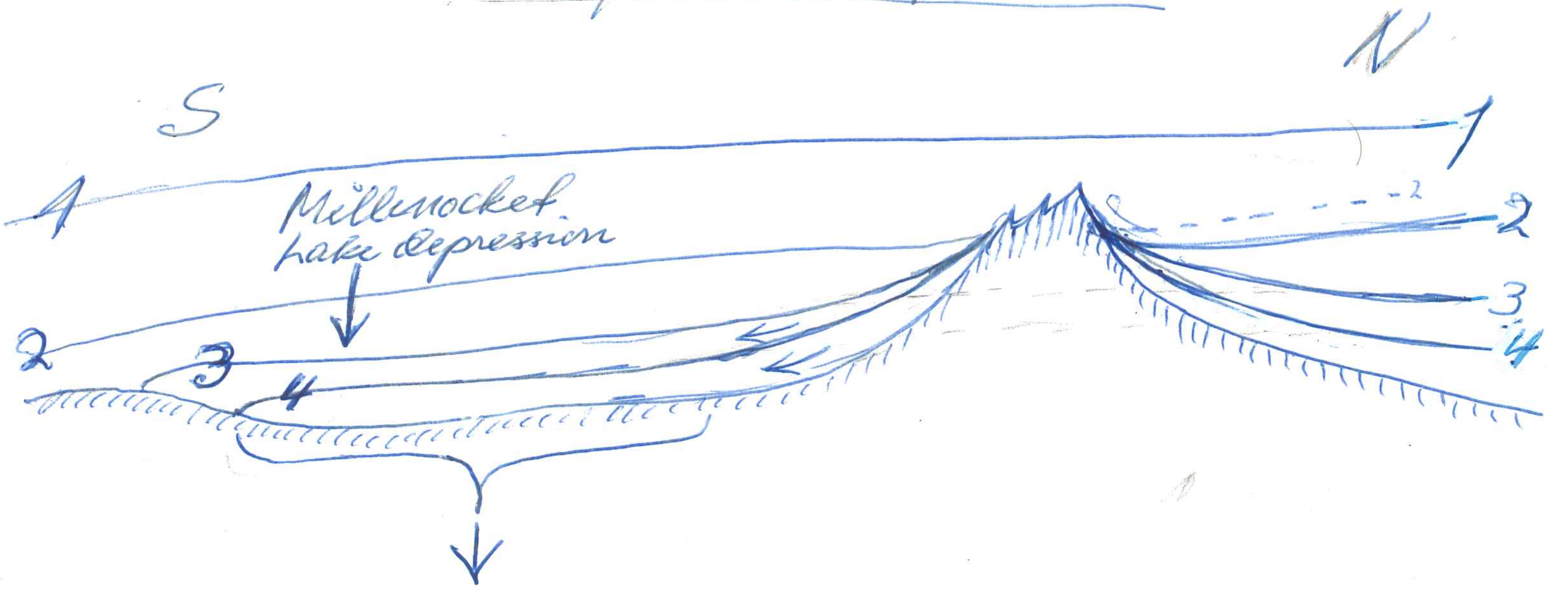
The marine limit

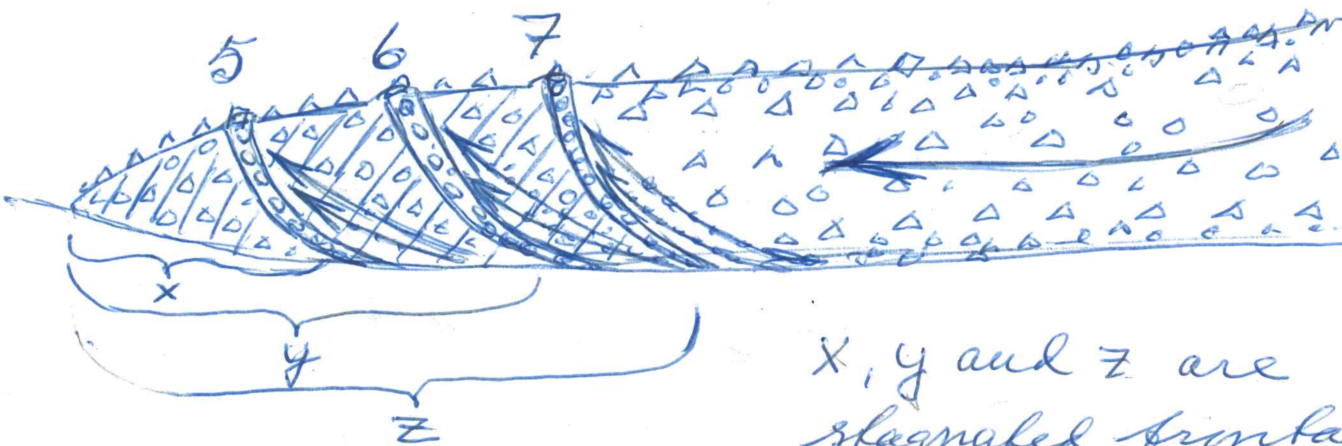
No well-developed shore features were observed, and the observed finegrained marine deposits lie well below the suggested marine limit. Therefore, the marine-limit determinations had to be based on observed marine deltas. They in general lie in connection with the eskers which represent the main late glacial drainage systems, in Millinocket Valley and East Penopscot Valley. The eskers frequently have flat-topped surfaces, which have been marked with red colouring and special scravations, see explanation to the maps. The esker ridges were most likely formed successively as the ice-front retreated, in more or less open channels close to the ice-front. Therefore the corresponding glacial river was "graded to sea level". The highest lying flat-surfaces on the esker probably correspond approximately with sea level, and represent "delta plains". The current may have been swift in the channel at the ice front, and therefore erosion may have occurred below sea level, and thus formed flat-surfaces at slightly lower levels than MG. This is problematic when flat-surfaces on eskers are used to determine the MG. However, a few well-developed deltas, even one with good topset and forest beds, have been a good help in determining MG.

The East Branch of Penobscot-River

Observe the extensive flat surfaces on the esker along this river. The most extensive flat-surfaces lie between the 360 and 390 feet contours. Very large surfaces lie between 380 f. and 390 f. levels. The parts of the esker ridge which rise above the 390 f. level are generally sharply ridge-shaped, although narrow flat-surfaces exist between 390 f. and 400 f. The highest lying parts of the observed esker lie at approximately 410 f. At two localities the esker-ridge widens into delta-like plains between 370 and 390 f. levels. Since most of the large flat-surfaces too lie at this level, I considered this to be the most likely bracket for ML. However, a gravel pit in a delta near the northern limit of Whetstone Mts Quadrangle showed well developed gravelly topset beds on top of forest beds. The delta plain lies slightly above 390 f., and it indicates a sea level at about that level, Therefore, the 390 foot level was considered to be the most likely ML in this valley.

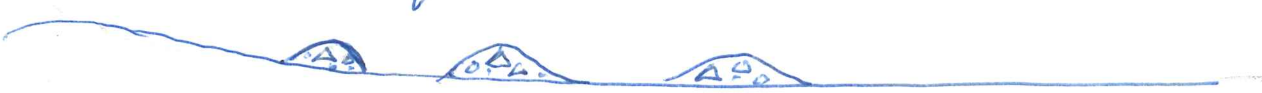
7 deglaciation phases





x, y and z are stagnated frontal parts of the ice during phases 5, 6 and 7 respectively.

The final result



The time-difference between phases 5, 6 and 7 can be very short.

The Dolby Pond Delta

This delta is a fairly large well developed delta where the delta plain lies between 370 and 390 f. There are several levels on the delta and the highest-lying level lies close to 390 f. Therefore, I supposed that the sea level corresponding to the delta was about 390 f. during an early phase and between 370 and 380 f. during a later phase of the delta formation.

The Millinocket area

The flat-topped esker ridge on the west side of the river has a plain between 380 and 390 f. However, the much larger plains on the east side lie between 390 and 410 f. They are covered with sand, and they supposedly represent delta plains corresponding with the esker system in this valley. The plain at Little Italy Cemetary, at the 410 f. level, most likely represent the ML. This is 20 f. higher (7 m higher) than the suggested ML in the other areas. The question now arises, which is the correct altitude for ML, the 410 f. level or the 390 f. level, or could they both be correct? I have no good answer to this question. I have considered a possible blocking with ice down valley from Millinocket, and therefore a damming to the 410 f. level at Millinocket. However, that seems rather unlikely. I have also considered the possibility of a variable sea level caused by tidal changes. Could it be that the 410 f. level represents a high-tide level which the Millinocket river was graded to? Then the question arises, why are the other deltas not built up to the same level? I can't get further. The ML in the Medway-Millinocket area must lie somewhere between 410 f. and 380 f.

The age of the deglaciation

The only way to determine the age of the deglaciation without doing any coring is by means of fossils which can be radiocarbon dated. Marine fossils have been observed in glaciomarine clays from the Medway-East Millinocket area. I spent much time looking for marine macrofossils in the finegrained marine deposits which I observed. Most of the deposits are silts with little or no clay, and they contained no macrofossils. The only place where I found good glaciomarine clays was in the gravel pit on the south bank of Penopseot River, about 1 km south of Medway. This clay was sampled, and reports from professor Borns tell that forams have been found in the clay. In that case it should be possible to radiocarbon date the glaciomarine clay and the time of deglaciation.

Glacial striation

Glacial striation has been observed at three localities near Millinocket and at one locality at the outlet of Dolby Poned. The two localities to the west of Millinocket show a change from about N-S to a more southeasterly direction, and the Dolby Pond locality shows a change from about N-S to a more southwesterly direction. All of the oldest striae are directed towards about S10°E, and they probably show the flow direction of the main ice sheet. The younger sets of striae are formed by glaciers where the flow was strongly influenced by the local topography.

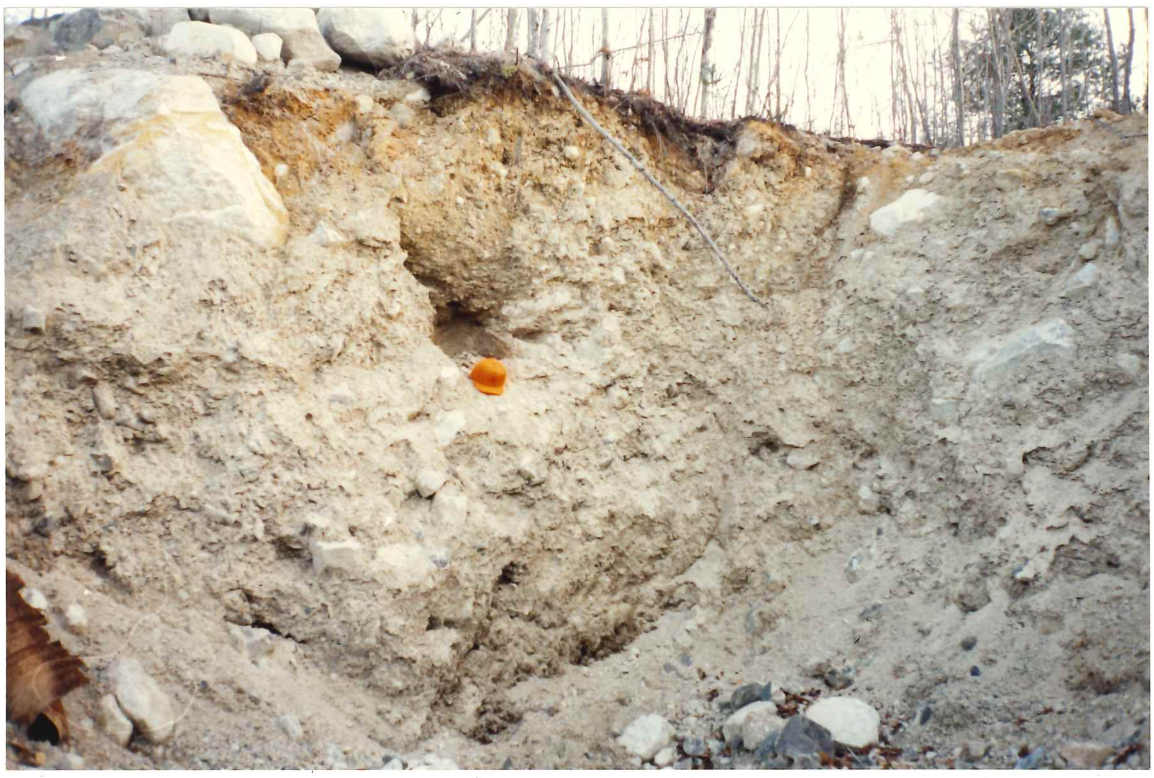
Pit 2 on the Norcross Quadrangle.

About 6 m of sandy, gravelly till with many boulders was exposed. No pebble-orientation and no stratification was observed. However, there is clearly more large boulders in the lower part.

Pit 3 on the Norcross Quadrangle.

Scale: the red hat on the largest boulder.
A sandy till with large boulders is exposed from base to top of the about 4 m high pit-wall. The pebbles(cobbles and boulders are mainly of granite, and they gave no preferred orientation.
No stratification was observed.

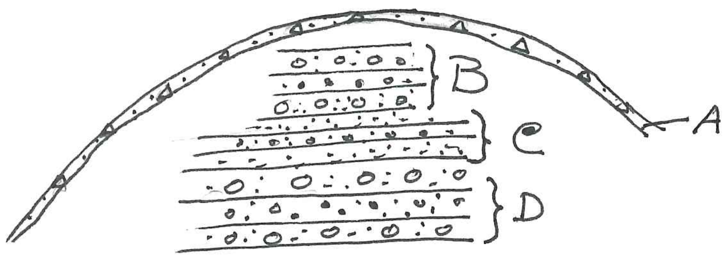
Pit 4 This pit lies in a broad ridge. I marked this as a ribbed moraine, but it is definitely of a different kind than the typical ribbed moraines. There is no goo vertical section in the pit, but numerous large boulders (1 m - 3 m) are exposed. They seem to dominate the ridge, and they are clearly glacially striated. The direction of the glacial striation is S 0° to S 20°E. Therefore this ridge is most likely formed at the base of a glacier.



Pit 5 on the Norcross Quadrangle.

Maximum 5 m of sandy, bouldery till was exposed. No pebble-orientation and no stratification was observed.

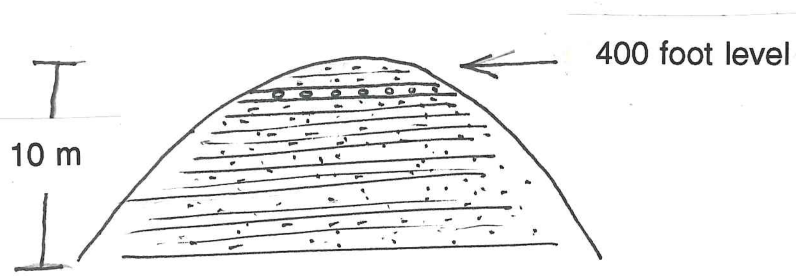
"Depression" between the ribbed moraines near Pit 1 and Pit 2. Most of the depressions are covered with large boulders, and no glaciofluvial sediments were observed in the ribbed moraine areas on the Norcross Quadrangle.



Pit 7 on the Millinocket Quadrangle

A: a thin till-layer
B: 3 m bouldery gravel
C: 2 m stratified sand and gravel
D: 3 m bouldery gravel

The pit wall covers a central section of the esker ridge in Millinocket Valley.



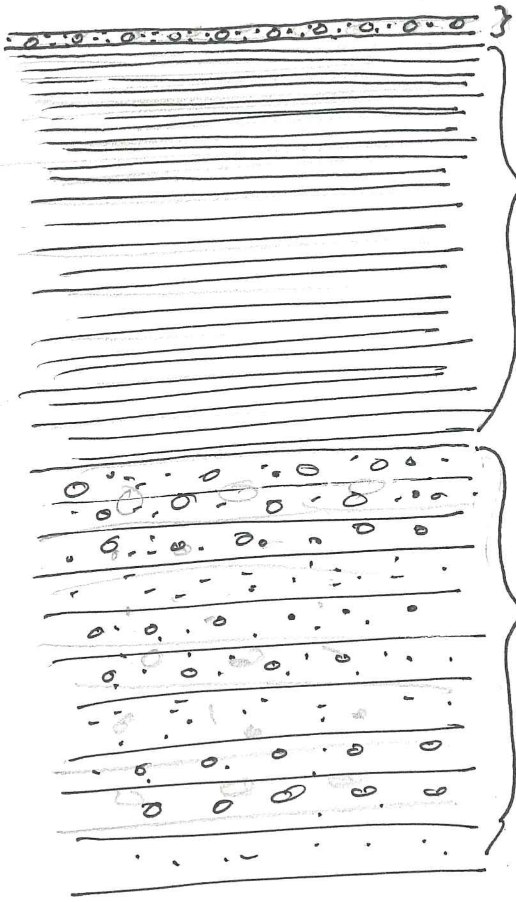
Pit 8 on the Millinocket Quadrangle

An about 10 m section in a mound in the esker system.
Flat-lying to slightly dipping beds and laminae of mainly medium sand dominate. An about 1/2 m thick bed of pebble gravel lies about 1 m below the top.
This can be a unit of marine (lacustrine?) sediments deposited in an inactive esker, tunnel or chamber.

Pit 9 on the Trout Mt Quadr.

The pit (road cut) shows an about 3 m section in a ribbed moraine. Till of exactly the same type as the tills in Pits, 2, 3 and 5 is exposed.

Pit 10, on the Medumkeunk Lake Quadr., see next illustration.

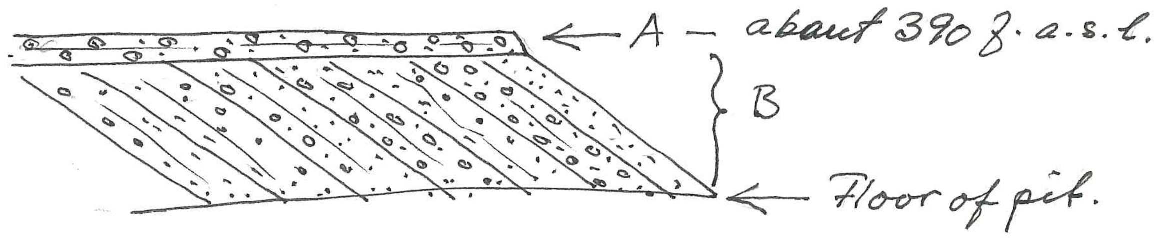


A	1/2 m	pebbly-cobbly gravel
B	6 - 8 m	stratified, in part laminated, sand and silt. Some of the silt is clayey. Unit 13 is brown oxidized, except in small areas where it is grey and unoxidized. No fossils were observed.
C	10 - 12 m	stratified sand and gravel with large boulders. Some tectonic, collapse-structures were observed.

Pit 10 is a very large gravel pit on the Medunkeunk Lake Quadrangle.

Unit A is most likely a beach gravel.
Unit B is most likely glaciomarine, since it lies below ML.
Unit C is clearly glaciofluvial, a part of the esker-system, see the map.

See also the previous picture.



Pit 11 on Whetstone Mountain Quadr.

The pit shows an about 5 m exposure in a delta, adjacent to the large esker in Penobscot River Valley.

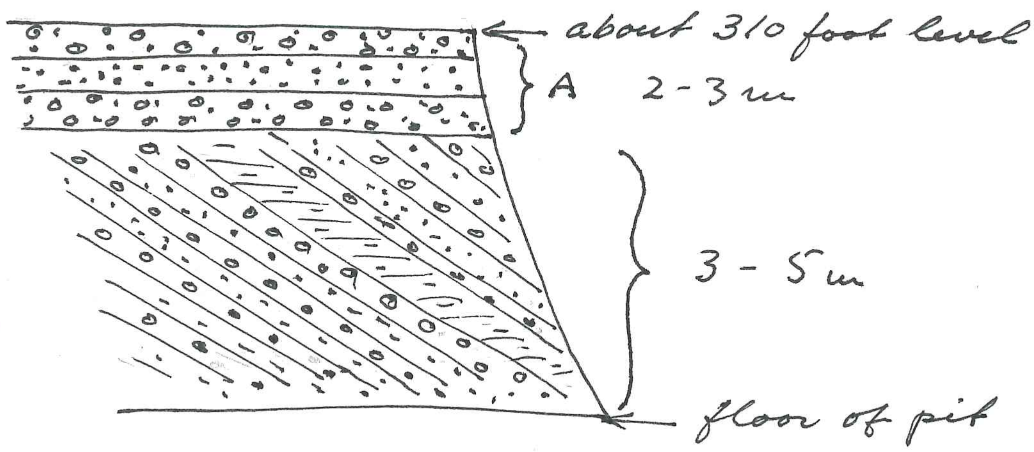
A: 1/2 - 1 foot of gravel in a topset bed.

B: 5 m foreset gravel and sand beds which dip 10°-15° in SEE-direction.

The top-surface, the delta plain, probably corresponds with ML.

See next picture.

Pit 11 on Whetstone Mountain Quadr. see proceeding illustration



Pit 12 on East Millinocket Quadr.

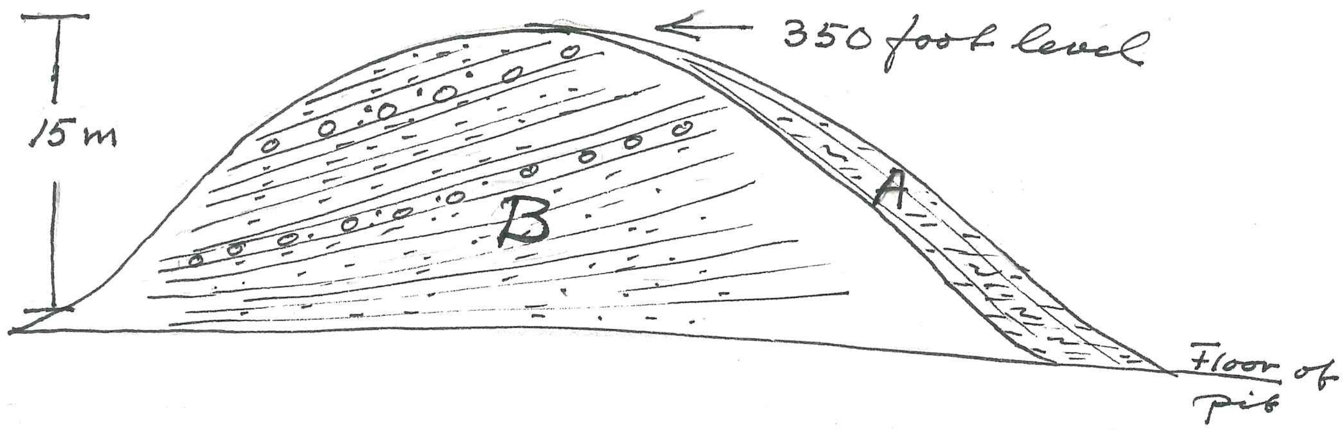
A: very bouldery gravel, crudely stratified

B: gravelbeds, and a 1/2-1 m thick bed with laminated siltclay, The beds dip about 20°SEE

The about 310 foot top surface is fairly flat.

Unit a consists of fairly flay-lying beds, very bouldery, which could be a delta-topset unit. Unit B is very likely a foreset unit.

If this is a delta, it definitely corresponds with a younger sea level than MG.



Pit 13 on the East Millinocket Quadr.

Cross-section through the esker ridge.

Unit A: A laminated silt/clay/fine-sand covers the west side of the ridge. The unit is max. 3 m - 4 m thick.

Unit B: Beds dipping 15° - 20° in the upper part and much less in lower part. They dip in SEE direction and consist of mainly coarse to medium sand with two zones of gravel.

Unit B is interpreted as a foreset unit deposited at the mouth of the esker channel.

Unit A are marine (glaciomarine) beds deposited during a following marine phase.

Pits 14 - 15 in the Dolby Pond Delta show 1 foot to 1 m thick gravelly topset units over 2 m to 3 m foreset sand beds which rest on flat-lying bottomsit sand/fine-sand beds where no more than 1 m - 2 m was exposed.

Legend to the maps

Till. I have mainly plotted the till along roads etc. where I have made direct observations. However, most of the "white" areas on the maps are till-covered also.

Morainal ridges

Druminoid hill or mountain

Morainal or glaciofluvial deposits

Probably glaciofluvial deposits.

Glaciofluvial deposits

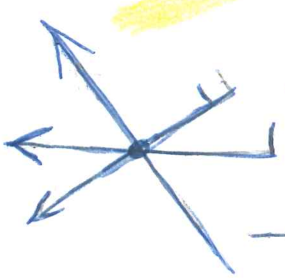
C B A B C D E F

Zones on an esker system or on a glaciofluvial delta.

A: Sharp esker ridge
B, C, D, E, F: flat surfaces at different altitudes on the esker system or delta.
B: 410-420 f ; C: 400-410 f.
D: 390-400 f ; E: 380-390 f.
F: 370-380 f

Marine deposits, usually silt and fine-sand
The marine deposits are commonly covered with a thin layer of postglacial sediments.

Fluvial sediments, post-glasial



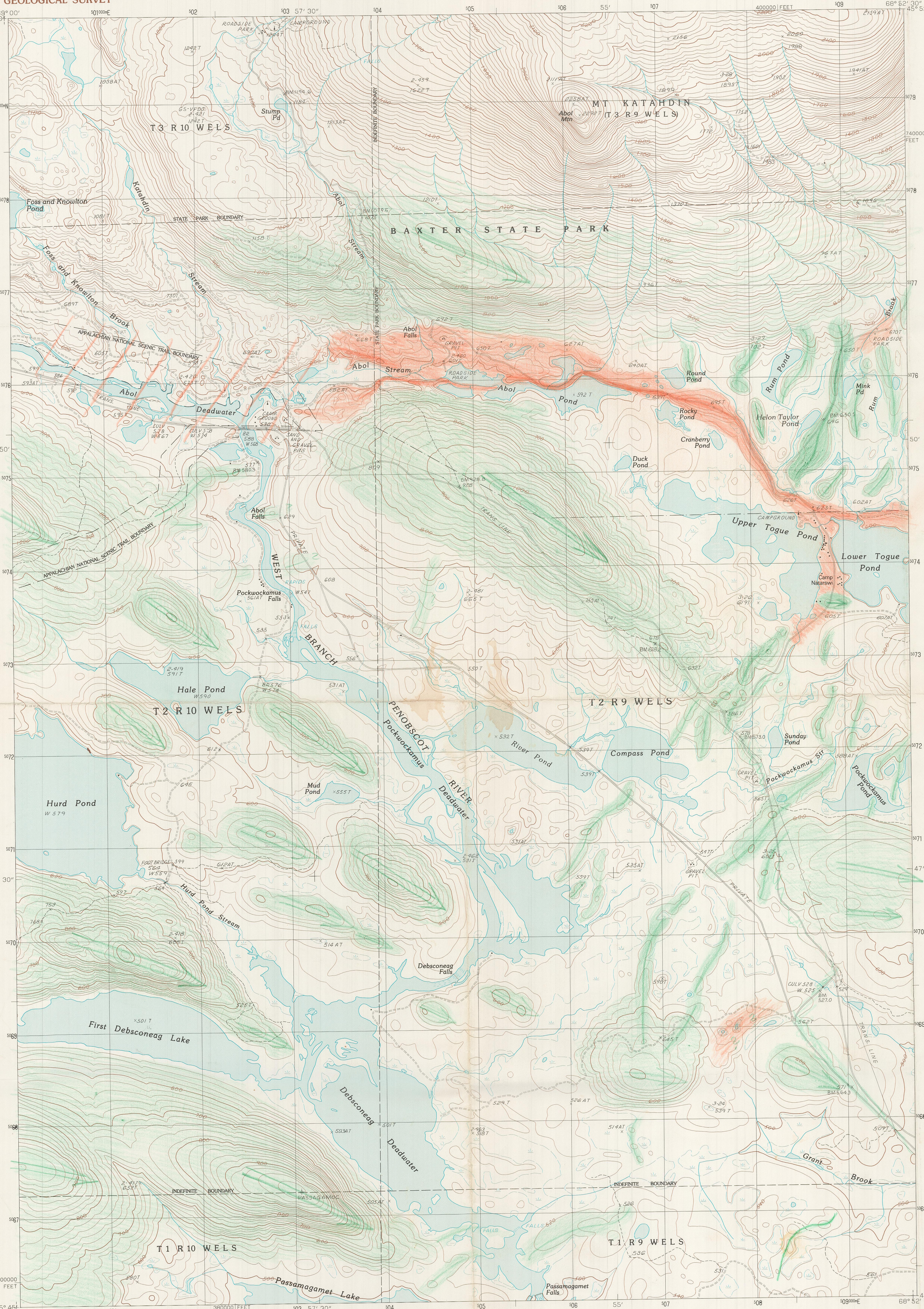
– Oldest
– Next oldest
— Youngest

sets of glacial striation
The dot marks the point of observation.

Pit 5 Gravel pit nr. 5.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ABOL POND QUADRANGLE
MAINE–PISCATAQUIS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



SCALE 1:24 000

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1988

MILES

FEET

KILOMETERS

METERS

CONTOUR INTERVAL 20 FEET

CONTROL ELEVATIONS SHOWN TO THE NEAREST 0.1 FOOT
OTHER ELEVATIONS SHOWN TO THE NEAREST FOOT

To convert feet to meters multiply by .3048
To convert meters to feet multiply by 3.2808

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY .... USGS AND NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1982
FIELD CHECKED .... 1985. MAP EDITED 1988
PROJECTION .... TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR .... ZONE 19
10,000-FOOT STATE GRID TICKS .... MAINE, EAST ZONE
UTM GRID DECLINATION .... 0°03′ EAST
1988 MAGNETIC NORTH DECLINATION .... 19°00′ WEST
VERTICAL DATUM .... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM .... 1927 NORTH AMERICAN DATUM

To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (1 meter south and 43 meters west)
There may be private inholdings within the boundaries of any Federal and State reservations shown on this map
No distinction made between houses, barns, and other buildings

NORTH

PROVISIONAL MAP
Produced from original manuscript drawings. Information shown as of date of photography. 1

MAINE
QUADRANGLE LOCATION

1	2	3	1 Doubletop Mtn. 2 Mount Katahdin 3 Katahdin Lake 4 Rainbow Lake East 5 Trout Mtn. 6 Naha Makanta Stream 7 Pemadumcook 8 Norcross
4		5	
6	7	8	

ADJOINING 7.5′ QUADRANGLE NAMES

ROAD LEGEND

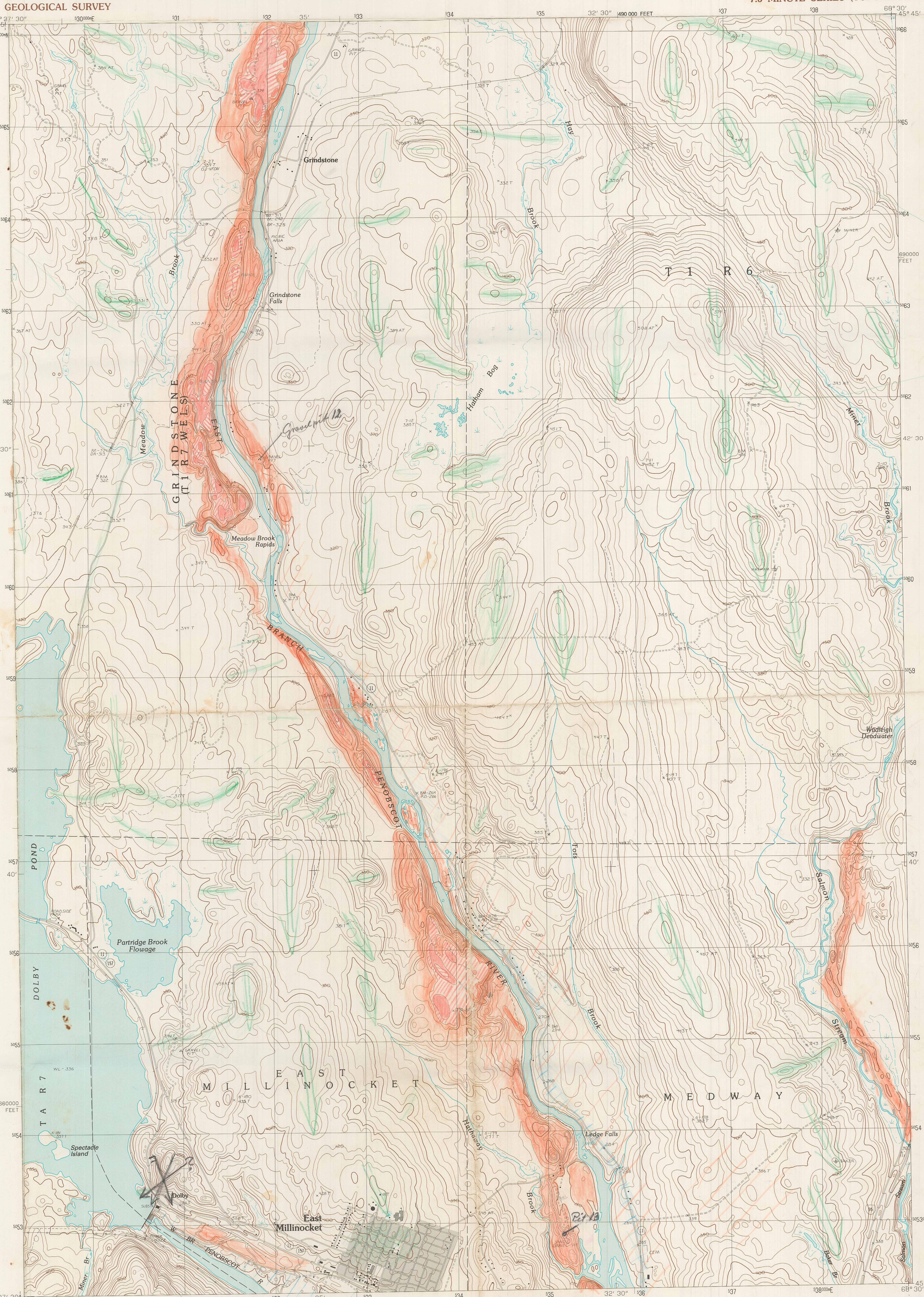
Improved Road ....
Unimproved Road ....
Trail ....
Interstate Route U. S. Route State Route

ABOL POND, MAINE
PROVISIONAL EDITION 1988

45068-G8-TF-024

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EAST MILLINOCKET QUADRANGLE
MAINE–PENOBSCOT CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Bedrock controlled?

PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY .... USGS, NOS/NOAA, AND MDOT
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1984
FIELD CHECKED .... 1986. MAP EDITED 1988
PROJECTION .... TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR .... ZONE 19
10,000-FOOT STATE GRID TICKS .... MAINE, EAST ZONE
UTM GRID DECLINATION .... 0°19′ EAST
1988 MAGNETIC NORTH DECLINATION .... 19°30′ WEST
VERTICAL DATUM .... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM .... 1927 NORTH AMERICAN DATUM

To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (1 meter south and 44 meters west)

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PROVISIONAL MAP
Produced from original manuscript drawings. Information shown as of date of photography. 1

NORTH

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1988

SCALE 1:24 000

MILES: 1 .5 0 1

FEET: 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000

KILOMETERS: 1 .5 0 1 2

METERS: 1000 0 1000 2000

CONTOUR INTERVAL 10 FEET
To convert feet to meters multiply by .3048
To convert meters to feet multiply by 3.2808

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

MAINE
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Whetstone Mtn.
2 Stacyville
3 Benedicta
4 Millinocket
5 Salmon Stream Lake
6 Nollesemic Lake
7 Medunkeunk Lake
8 Mattaseunk Lake

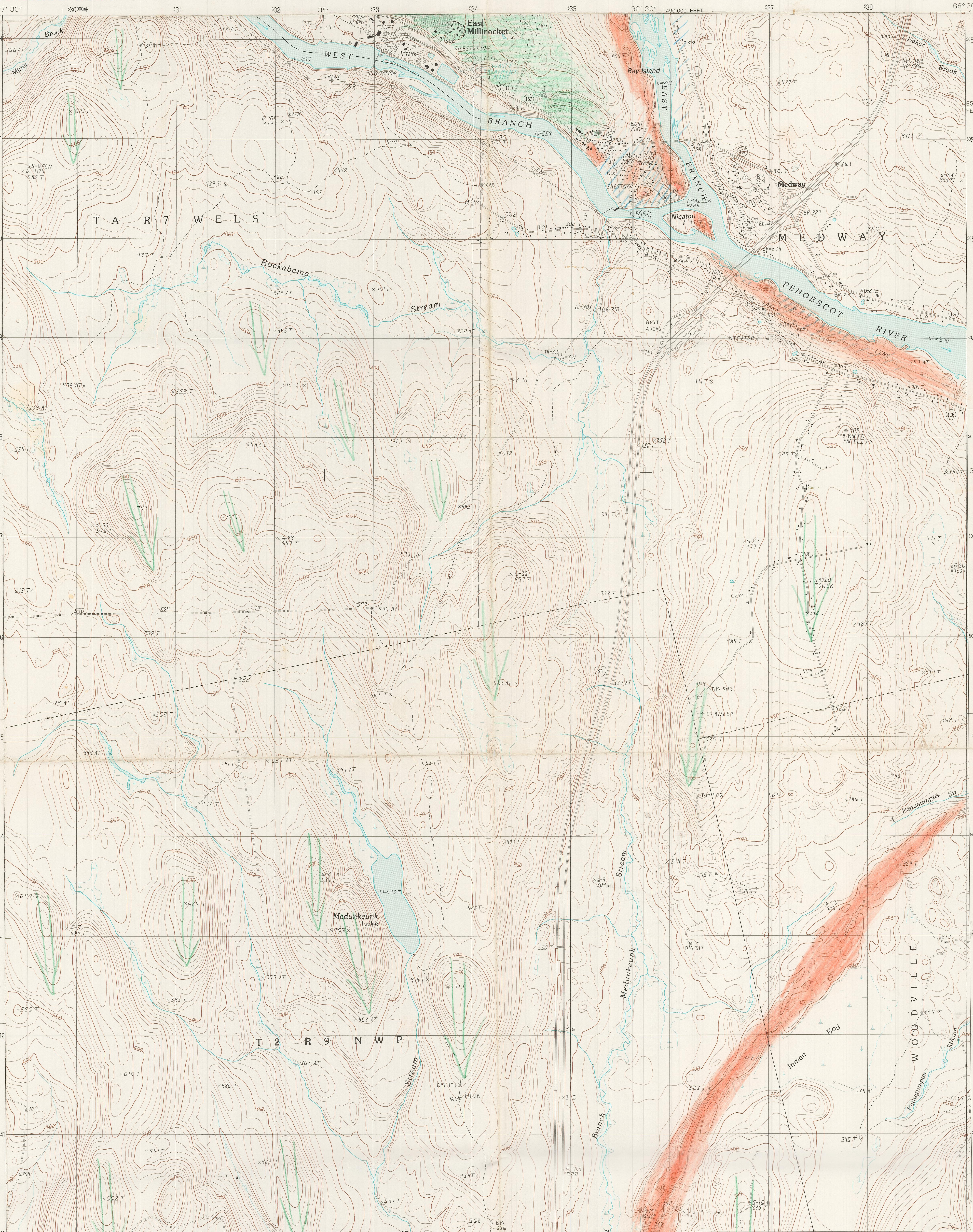
ADJOINING 7.5′ QUADRANGLE NAMES

ROAD LEGEND
Improved Road ....
Unimproved Road ....
Trail ....
Interstate Route U. S. Route State Route

EAST MILLINOCKET, ME.
PROVISIONAL EDITION 1988
45068-E5-TF-024

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MEDUNKEUNK LAKE QUADRANGLE
MAINE–PENOBSCOT CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY .... USGS AND NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1984
FIELD CHECKED .... 1986. MAP EDITED 1988
PROJECTION .... TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR .... ZONE 19
10,000-FOOT STATE GRID TICKS .... MAINE, EAST ZONE
UTM GRID DECLINATION .... 0°19′ EAST
1988 MAGNETIC NORTH DECLINATION .... 19°30′ WEST
VERTICAL DATUM .... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM .... 1927 NORTH AMERICAN DATUM

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All islands in the Penobscot River are part of the Penobscot Indian Reservation except Nicatou Island

NORTH

PROVISIONAL MAP
Produced from original manuscript drawings. Information shown as of date of photography. 1

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1988

SCALE 1:24 000

MILES

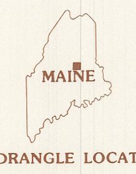
FEET

KILOMETERS

METERS

CONTOUR INTERVAL 10 FEET
To convert feet to meters multiply by .3048
To convert meters to feet multiply by 3.2808

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, C[illegible] 80225, OR RESTON, VIRGINIA 22092



QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Millinocket
2 East Millinocket
3 Salmon Stream Lake
4 Nollesemic Lake
5 Mattaseunk Lake
6 Mattamiscontis Mtn.
7 Nine Meadow Ridge
8 Lincoln Center

ADJOINING 7.5′ QUADRANGLE NAMES

ROAD LEGEND

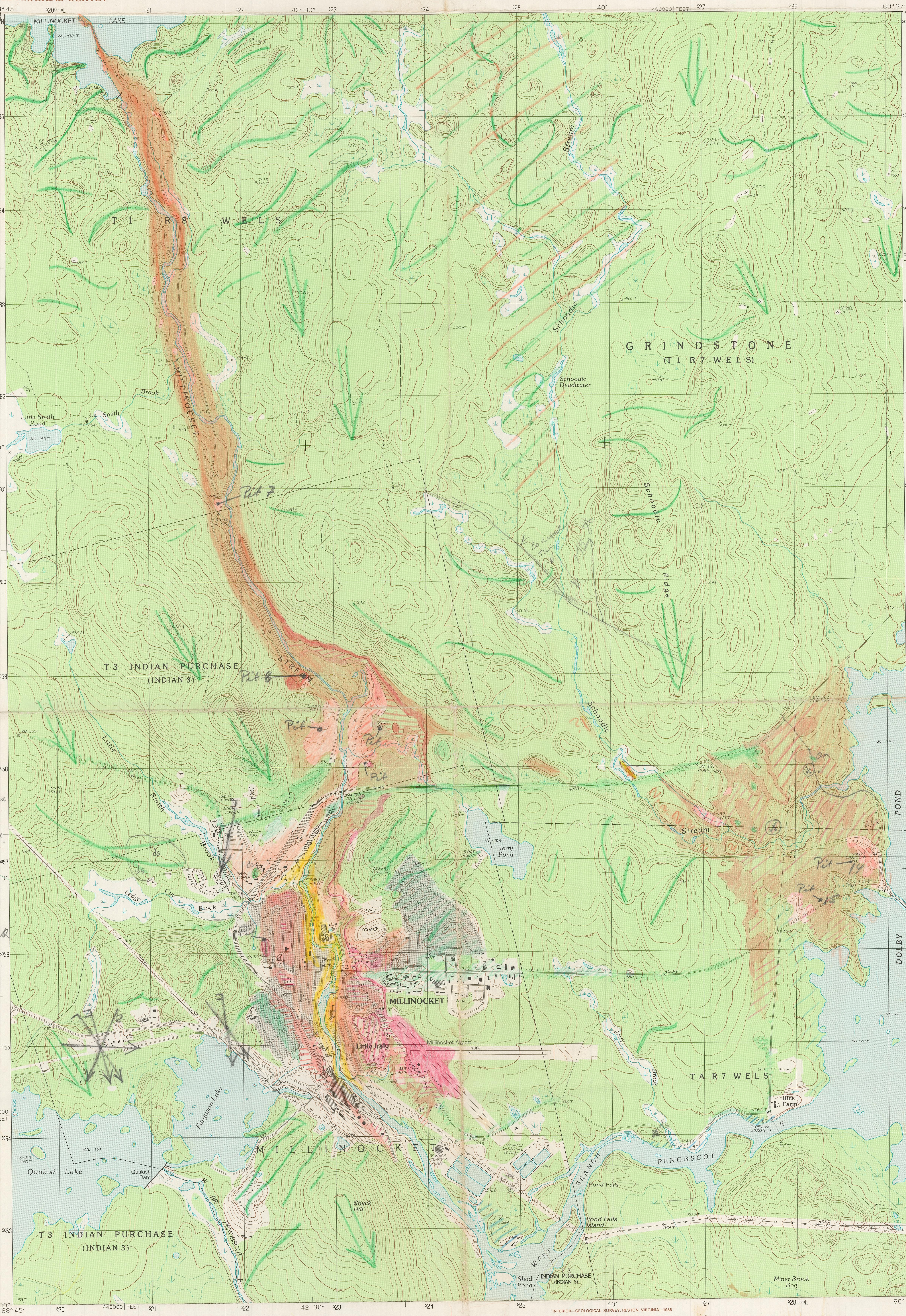
Improved Road ....
Unimproved Road ....
Trail ....
Interstate Route U. S. Route State Route

MEDUNKEUNK LAKE, ME.
PROVISIONAL EDITION 1988

45068-E5-TF-024

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MILLINOCKET QUADRANGLE
MAINE–PENOBSCOT CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



0.0 S&S turn rt.
0.7 blinking lt. - turn lt. onto Eastland Ave.
0.9 rt. at stopsign
1.0 pull in to sand lot on lt. under power lines climb to top (cemetery)
continue on Granite St.
1.2 cross Mill stream
1.3 T, turn rt. on to
1.5 lt on rt. 11 immediately cross RR tracks on uphill
2.0 turn lt. on Golden Rd.
2.1 @ striation outcrop

turn lt. on:
1.8 F.R. 17

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1988

PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY .... USGS AND NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1984
FIELD CHECKED .... 1986. MAP EDITED 1988
PROJECTION .... TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR .... ZONE 19
10,000-FOOT STATE GRID TICKS .... MAINE, EAST ZONE
UTM GRID DECLINATION .... 0°13′ EAST
1988 MAGNETIC NORTH DECLINATION .... 19°30′ WEST
VERTICAL DATUM .... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM .... 1927 NORTH AMERICAN DATUM
To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (1 meter south and 44 meters west)
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Gray tint indicates area in which selected buildings are shown

NORTH

PROVISIONAL MAP
Produced from original manuscript drawings. Information shown as of date of photography. 1

SCALE 1:24 000

MILES: 1 .5 0 1
FEET: 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000
KILOMETERS: 1 .5 0 1 2
METERS: 1000 0 1000 2000

CONTOUR INTERVAL 10 FEET
To convert feet to meters multiply by .3048
To convert meters to feet multiply by 3.2808

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

MAINE
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Trout Mtn.
2 Whetstone Mtn.
3 Stacyville
4 Norcross
5 East Millinocket
6 Cedar Lake
7 Nollesemic Lake
8 Medunkeunk Lake

ADJOINING 7.5′ QUADRANGLE NAMES

ROAD LEGEND
Improved Road ....
Unimproved Road ....
Trail ....
Interstate Route   U. S. Route   State Route

MILLINOCKET, MAINE
PROVISIONAL EDITION 1988
45068-F6-TF-024

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

NORCROSS QUADRANGLE
MAINE
7.5 MINUTE SERIES (TOPOGRAPHIC)

PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY .... USGS AND NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1982
FIELD CHECKED .... 1984. MAP EDITED 1988
PROJECTION .... TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR .... ZONE 19
10,000-FOOT STATE GRID TICKS .... MAINE, EAST ZONE
UTM GRID DECLINATION .... 0°08′ EAST
1988 MAGNETIC NORTH DECLINATION .... 19°00′ WEST
VERTICAL DATUM .... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM .... 1927 NORTH AMERICAN DATUM

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PROVISIONAL MAP
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SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
To convert feet to meters multiply by .3048
To convert meters to feet multiply by 3.2808

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MAINE
QUADRANGLE LOCATION

1	2	3	1 Abol Pond 2 Trout Mtn. 3 Whetstone Mtn. 4 Pemadumcook Lake 5 Millinocket 6 Ragged Mtn. 7 Cedar Lake 8 Nollesemic Lake
4		5	
6	7	8	

ADJOINING 7.5′ QUADRANGLE NAMES

ROAD LEGEND

Improved Road ....
Unimproved Road ....
Trail ....

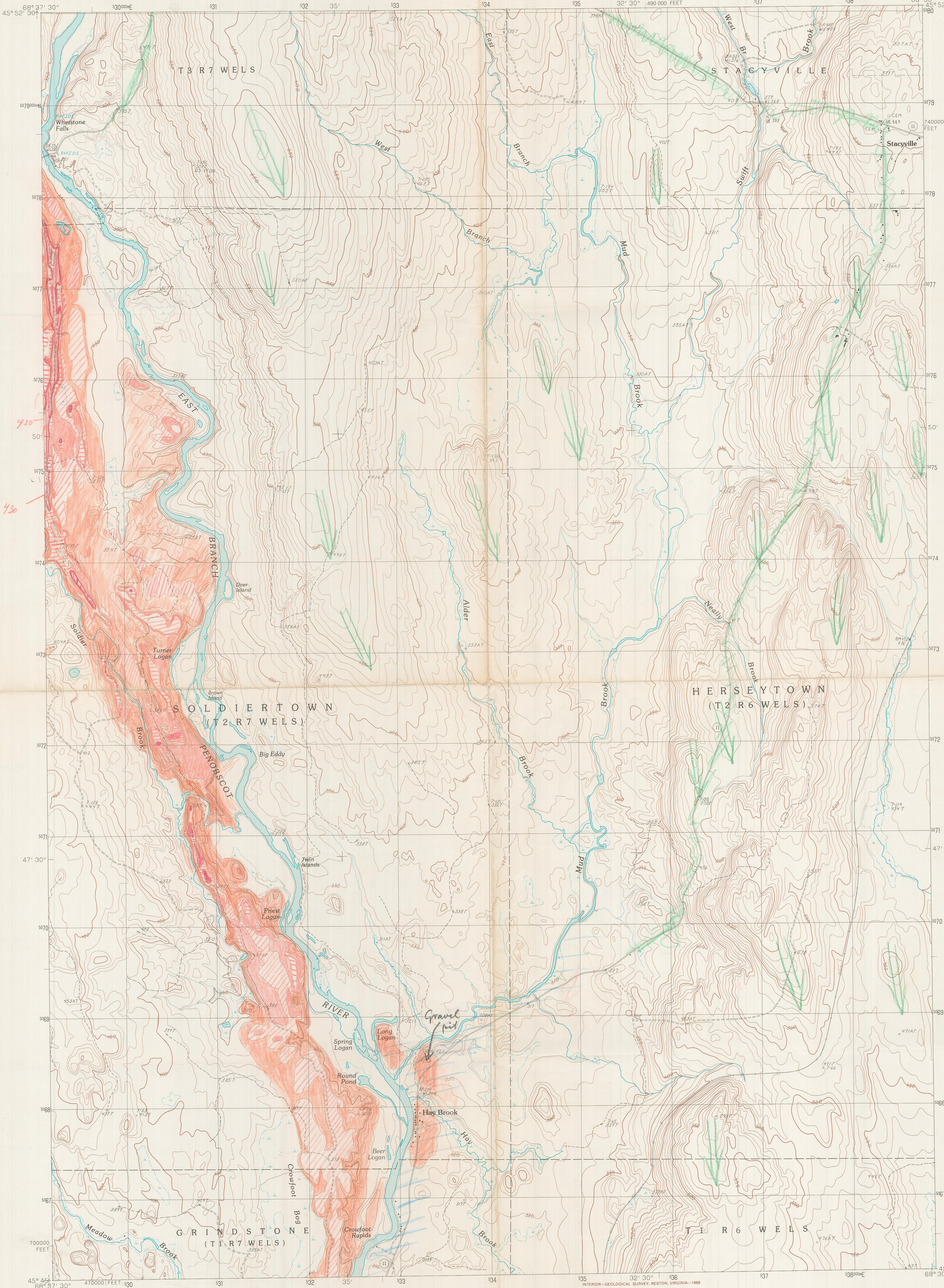
Interstate Route U. S. Route State Route

NORCROSS, MAINE
PROVISIONAL EDITION 1988

45068-F7-TF-024

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STACYVILLE QUADRANGLE
MAINE–PENOBSCOT CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1989

PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY .... USGS AND NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1984
FIELD CHECKED .... 1986. MAP EDITED 1989
PROJECTION .... TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR .... ZONE 19
10,000-FOOT STATE GRID TICKS .... MAINE, EAST ZONE
UTM GRID DECLINATION .... 0°19′ EAST
1989 MAGNETIC NORTH DECLINATION .... 19°30′ WEST
VERTICAL DATUM .... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM .... 1927 NORTH AMERICAN DATUM

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NORTH

PROVISIONAL MAP
Produced from original manuscript drawings. Information shown as of date of photography. 1

SCALE 1:24 000

KILOMETERS · METERS · MILES · FEET

CONTOUR INTERVAL 10 FEET

To convert meters to feet multiply by 3.2808
To convert feet to meters multiply by .3048

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

MAINE
QUADRANGLE LOCATION

1 Deasey Mtn.
2 Lookout Mountain
3 Patten
4 Whetstone Mountain
5 Benedicta
6 Millinocket
7 East Millinocket
8 Salmon Stream Lake

ADJOINING 7.5′ QUADRANGLE NAMES

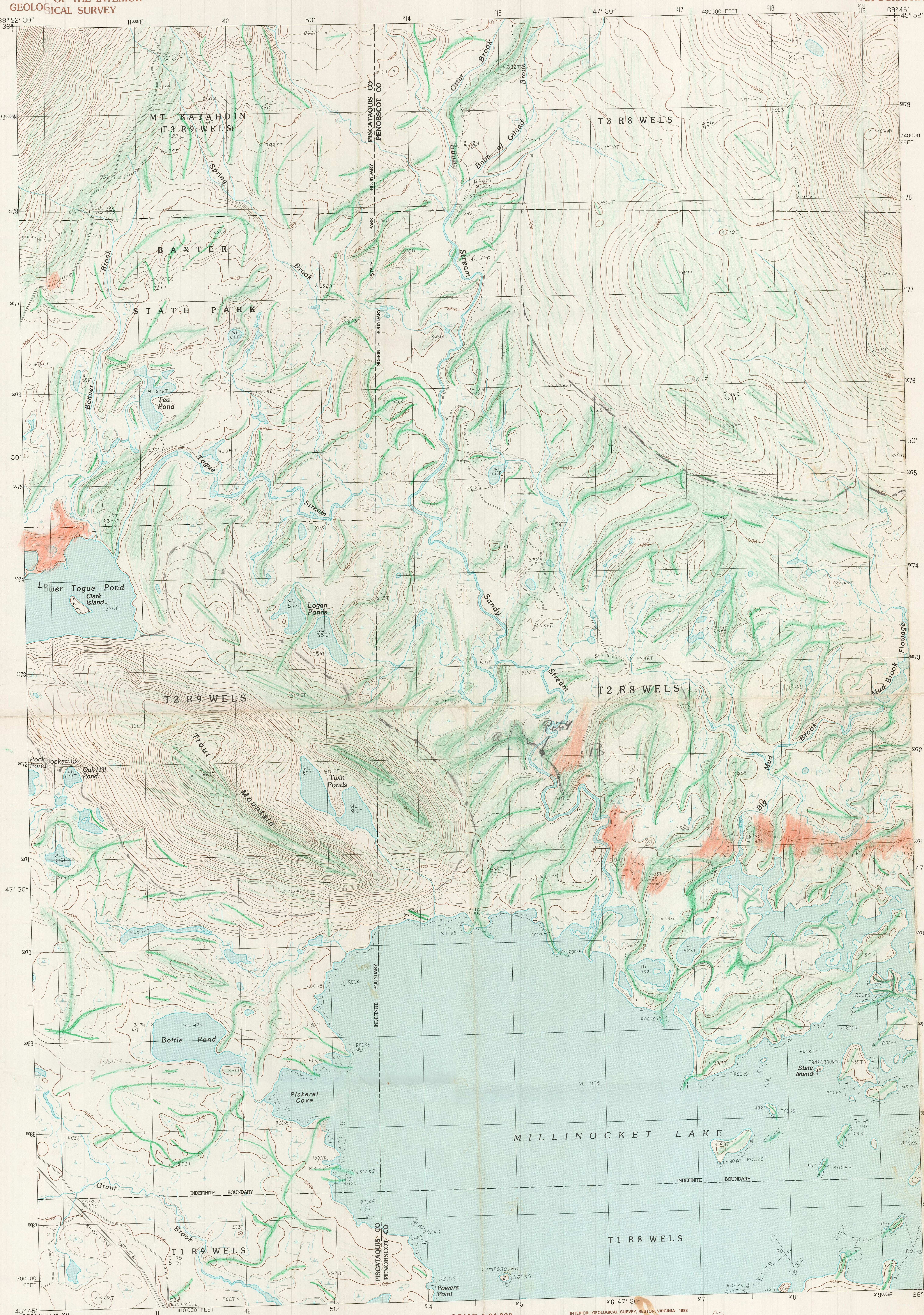
ROAD LEGEND

Improved Road
Unimproved Road
Trail
Interstate Route · U. S. Route · State Route

STACYVILLE, MAINE
PROVISIONAL EDITION 1989
45068-G5-TF-024

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TROUT MTN. QUADRANGLE
MAINE
7.5 MINUTE SERIES (TOPOGRAPHIC)



PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY .... USGS AND NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1982
FIELD CHECKED .... 1985. MAP EDITED 1988
PROJECTION .... TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR .... ZONE 19
10,000-FOOT STATE GRID TICKS .... MAINE, EAST ZONE
UTM GRID DECLINATION .... 0°08′ EAST
1988 MAGNETIC NORTH DECLINATION .... 19°30′ WEST
VERTICAL DATUM .... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM .... 1927 NORTH AMERICAN DATUM

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NORTH

PROVISIONAL MAP
Produced from original manuscript drawings. Information shown as of date of photography. 1

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1988

SCALE 1:24 000

1 .5 0 1 MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000 FEET
1 .5 0 1 2 KILOMETERS
1000 0 1000 2000 METERS

CONTOUR INTERVAL 20 FEET

CONTROL ELEVATIONS SHOWN TO THE NEAREST 0.1 FOOT
OTHER ELEVATIONS SHOWN TO THE NEAREST FOOT
To convert feet to meters multiply by .3048
To convert meters to feet multiply by 3.2808

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

MAINE
QUADRANGLE LOCATION

1	2	3	1 Mount Katahdin 2 Katahdin Lake 3 Deasey Mtn. 4 Abol Pond 5 Whetstone Mountain 6 Pemadumcook 7 Norcross 8 Millinocket
4		5	
6	7	8	

ADJOINING 7.5′ QUADRANGLE NAMES

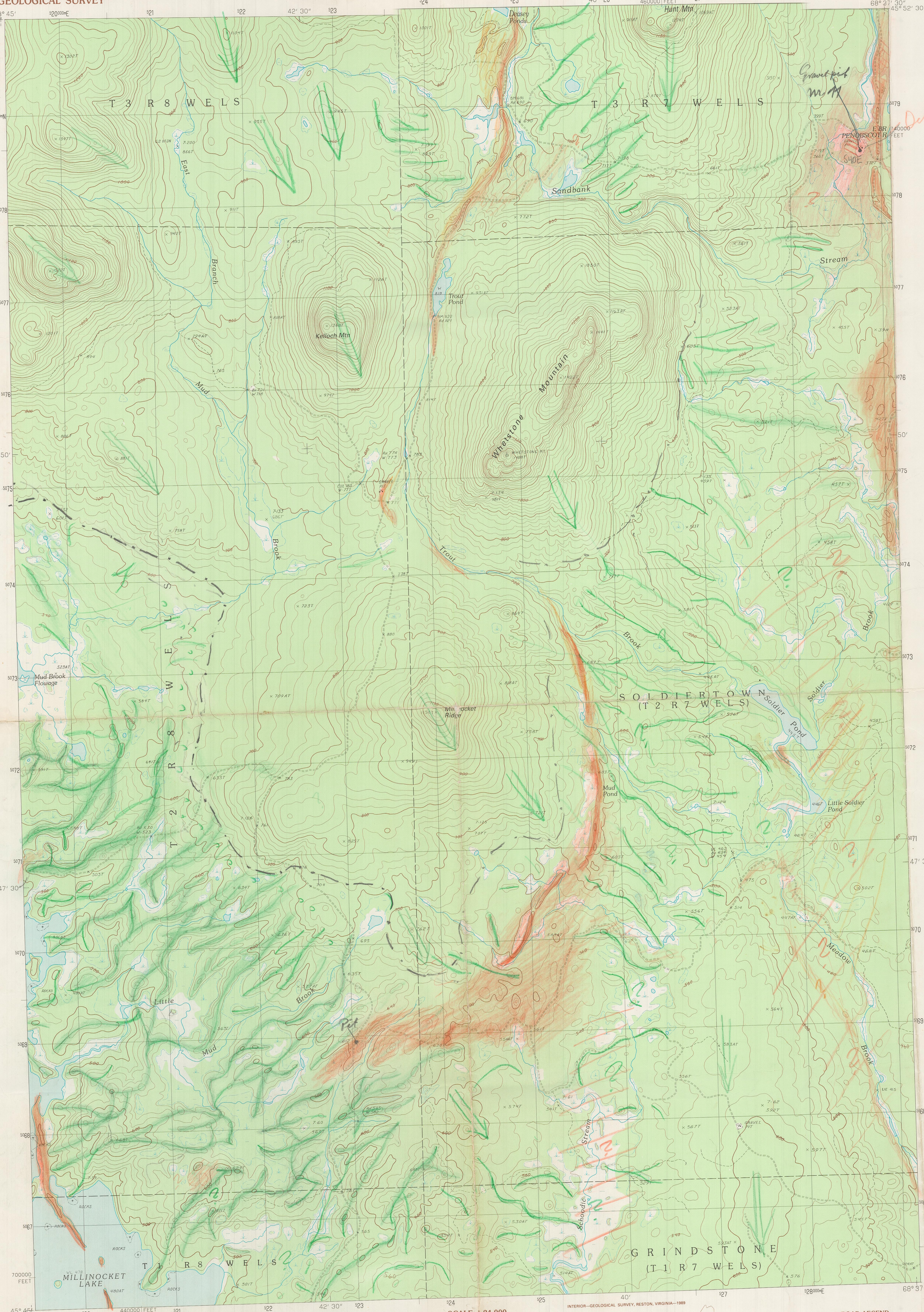
ROAD LEGEND

Improved Road ....
Unimproved Road ....
Trail ....
Interstate Route U. S. Route State Route

TROUT MTN., MAINE
PROVISIONAL EDITION 1988
45068-G7-TF-024

DEPA UNITED STATES
PARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WHETSTONE MOUNTAIN QUADRANGLE
MAINE–PENOBSCOT CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1989

PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY........USGS AND NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN........1984
FIELD CHECKED........1986. MAP EDITED........1989
PROJECTION........TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR........ZONE 19
10,000-FOOT STATE GRID TICKS........MAINE, EAST ZONE
UTM GRID DECLINATION........0°13′ EAST
1989 MAGNETIC NORTH DECLINATION........19°30′ WEST
VERTICAL DATUM........NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM........1927 NORTH AMERICAN DATUM
To place on the predicted North American Datum of 1983 move the projection lines as shown by dashed corner ticks (1 meter south and 44 meters west)
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PROVISIONAL MAP
Produced from original manuscript drawings. Information shown as of date of photography. 1

NORTH

SCALE 1:24 000

KILOMETERS 1 .5 0 1 2
METERS 1000 0 1000 2000
MILES 1 .5 0 1
FEET 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000

CONTOUR INTERVAL 20 FEET

To convert meters to feet multiply by 3.2808
To convert feet to meters multiply by .3048

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DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

MAINE
QUADRANGLE LOCATION

1	2	3	1 Katahdin Lake 2 Deasey Mtn. 3 Lookout Mountain
4		5	4 Trout Mtn. 5 Stacyville
6	7	8	6 Norcross 7 Millinocket 8 East Millinocket

ADJOINING 7.5′ QUADRANGLE NAMES

ROAD LEGEND

Improved Road ....
Unimproved Road ....
Trail ....
Interstate Route U. S. Route State Route

WHETSTONE MOUNTAIN, MAINE
PROVISIONAL EDITION 1989
45068-G6-TF-024